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Voucher Trading System Application Programming Interface (VTS-API)

Status of This Memo

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IESG Note

This document is not a candidate for any level of Internet Standard. This document specifies the Voucher Trading System Application Programming Interface (VTS-API), which assumes that the VTS plug-in is trusted by its user. The application making calls to VTS-API ought to authenticate the VTS plug-in and securely bind the plug-in with the VTS provider information specified in the Voucher Component. However, this document does not specify an approach to application authentication. The VTS-API should not be used without being augmented by an application authentication mechanism.

Abstract

This document specifies the Voucher Trading System Application Programming Interface (VTS-API). The VTS-API allows a wallet or other application to issue, transfer, and redeem vouchers in a uniform manner independent of the VTS implementation. The VTS is a system for securely transferring vouchers; e.g., coupons, tickets, loyalty points, and gift certificates. This process is often necessary in the course of payment and/or delivery transactions.

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1. Introduction

This document specifies the Voucher Trading System Application Programming Interface (VTS-API). The motivation and background of the Voucher Trading System (VTS) are described in Requirements for Generic Voucher Trading [VTS].

A voucher is a logical entity that represents a certain right, and it is logically managed by the VTS. A voucher is generated by the issuer, traded among users, and finally collected using VTS. The terminology and model of the VTS are also described in [VTS].

VTSes can be implemented in different ways, such as a centralized VTS, which uses a centralized online server to store and manage all vouchers, or a distributed VTS, which uses per-user smartcards to maintain the vouchers owned by each user. However, the VTS-API allows a caller application to issue, transfer, and redeem vouchers in a uniform manner independent of the VTS implementation. Several attempts have been made to provide a generic payment API. Java Commerce Client [JCC] and Generic Payment Service Framework [GPSF], for example, introduce a modular wallet architecture that permits diverse types of payment modules to be added as plug-ins and supports both check-like/cash-like payment models. This document is inspired by these approaches but its scope is limited to the VTS model, in which the cash-like payment model is assumed and vouchers are directly or indirectly transferred between the sender (transferor) and receiver (transferee) via the VTS. This document is not intended to support API for SET, e-check, or other payment schemes that do not fit the VTS model.

Unlike the APIs provided in JCC and GPSF, which are designed to transfer only monetary values, this API enables the transfer of a wide range of values through the use of XML-based Generic Voucher Language [GVL]. The monetary meaning of the voucher is interpreted by the upper application layer using the information described in the language. This approach makes it possible to provide a simpler API in the voucher-transfer layer and enhances runtime efficiency. The

API specification in this document is described in the Java language syntax. Bindings for other programming languages may be completed in a future version of this document or in separate related specifications.

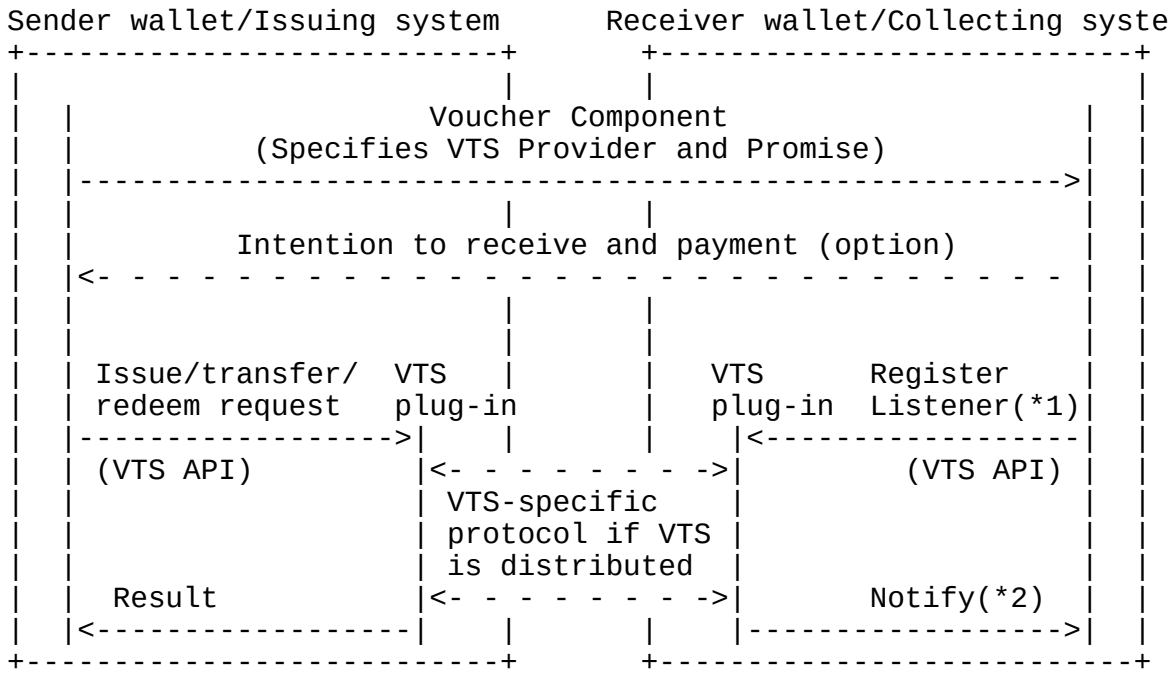
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119]

2. Processing Model

This section provides the processing model in which the VTS-API is used. A part of the text in this section has been taken from the Generic Voucher Language specification [GVL].

There are several ways to implement VTS. For discount coupons or event tickets, for example, a smartcard-based distributed offline VTS is often preferred, whereas for bonds or securities, a centralized online VTS is preferred. While distributed VTSes would utilize public (asymmetric) key-based or shared (symmetric) key-based cryptographic challenge-and-response protocols to trade vouchers securely, centralized VTSes would utilize transactions that rewrite ownerships of vouchers on their database. Therefore, it is impractical to define standard protocols for issuing, transferring, or redeeming vouchers at this time.

To provide implementation flexibility, this document assumes a modular wallet architecture that allows multiple VTSes to be added as plug-ins. In this architecture, instead of specifying a standard voucher transfer protocol, two specifications, Voucher Component and VTS-API, are standardized (Figure 1).



(*1) Registration is optional. Note also that the VTS plug-ins are usually pre-registered when the wallet or collecting system is started.

(*2) If a listener is registered.

Figure 1. Wallet architecture with VTS plug-ins

In this architecture, a VTS provides a logical view of vouchers called a Valid Voucher Set (VVS), which is a set that includes the vouchers <I,P,H> managed by the VTS [VTS]. A user's wallet can access (e.g., view, transfer, and redeem) the subset of the VVS that includes a set of vouchers owned by the user by interacting with the VTS plug-in via the VTS-API. Likewise, an issuing system can issue a voucher and add it to the VVS, and a collecting system can be notified of the redemption of vouchers via the VTS-API.

After a sender and a receiver agree on what vouchers are to be traded and which VTS is to be used, the issuing system or wallet system requests the corresponding VTS plug-in to permit the issue, transfer, or redemption transactions to be performed via the VTS-API. The VTS then logically rewrites the ownership of the vouchers on the VVS using the VTS-specific protocol. Since the VTS is responsible for preventing illegal acts on vouchers like forgery or reproduction, as required in [VTS], the protocol would include a cryptographic challenge-and-response (in a distributed VTS) or a transactional

database manipulation with adequate access controls (in a centralized VTS). Finally, a completion event is sent to the wallet systems or issuing/collecting systems.

This document describes the VTS-API specification. See [GVL] for the Voucher Component specification that gives the syntax and semantics for describing and interpreting the meaning of vouchers.

3. Design Overview

We have adopted the following approach to specify the VTS-API.

1) Provide an abstract and uniform API that encapsulates the VTS implementation. For example, a common API is provided for both centralized and distributed VTSes. Issuers and application developers have more freedom in VTS selection.

2) To provide an abstract and uniform API, this document introduces an interface called VTSAgent that is associated with a holder and provides methods to manipulate vouchers held by its holder. Vouchers are accessed through the methods provided by the VTSAgent.

3) Use existing standards for the VTS branding mechanism (negotiation). This document assumes that the VTS to be used for sending a voucher has settled the VTS-APIs are called. Negotiation can be done within the upper application layer using other standards (e.g., [IOTP] or [ECML]), if necessary.

4) Support only the push-type voucher transfer interface, in which the voucher transfer session is initiated by the transferor side. A pull-type voucher transfer interface can be implemented on top of the push-type VTS interface at the application level.

4. Concepts

The VTS-API consists of the following interfaces. A VTS is required to implement all of the interfaces except ReceptionListener, which is intended to be implemented by wallets or other applications that use VTS.

VTSManager
: Provides the starting point for using a VTS plug-in. All of the objects needed to manipulate vouchers can be directly or indirectly acquired via the VTSManager. A VTSManager maintains the two repositories: a ParticipantRepository and a VoucherComponentRepository, both of which are described below.

ParticipantRepository
: Provides the access points of participants that are to be trading partners. A ParticipantRepository maintains Participants and acts as an "address book" of trading partners.

Participant
: Represents a participant (such as an issuer, a holder, or a collector). A Participant interface knows how to obtain the corresponding VTSAgent described below.

VTSAgent (extends Participant)
: Provides the access point of vouchers in the Valid Voucher Set (VVS) that is logically managed by the VTS. A VTSAgent provides a means of manipulating vouchers held by its holder according to basic trading methods; i.e., issue, transfer, consume, and present. Before calling trading methods, the application must create a Session, which is described below.

Session
: Represents the logical connection established by the trade. A Session has references to two Participant interfaces; i.e., those of the sender and the receiver. After trading methods are called using a Session, the Session holds a reference to the Vouchers to be traded.

Voucher
: Represents one or more vouchers in which all of the issuer and promise parts of the vouchers are the same. A Voucher holds references to the Participant interface who issued the voucher (issuer) and to a VoucherComponent (promise), which is described below.

VoucherComponent
: Represents a Voucher Component, described in [GVL]. It defines the promise part of the voucher.

VoucherComponentRepository
: Provides the access points of VoucherComponents. A VoucherComponentRepository maintains VoucherComponents and acts as a "voucher type book" managed by the VTS. This document assumes that a set of VoucherComponents has been acquired and stored in this repository. Delivery of VoucherComponents is beyond the scope of this document. It may be delivered within the VTS from the trading partners or manually acquired from a trusted third party (see Section 3 of [GVL]).

ReceptionListener
Provides a listener function with regard to the receipt of a voucher by a VTSAgent to wallets or other applications that implement this interface. (This interface may not be implemented as part of the VTS.)

5. Interface Definitions

The interfaces defined in this document reside in the package named "org.ietf.vts". Wallets or other applications that use this API, should import this package as "import org.ietf.vts.*;".

5.1. VTSManager

public interface VTSManager

Provides the starting point for using a VTS plug-in.

All of the objects needed to manipulate vouchers can be directly or indirectly acquired via a VTSManager so that wallets or other applications can make the VTS available by instantiating an object implementing this interface.

A class that implements the VTSManager interface must have a public default constructor (a constructor without any parameters). The VTS provides a name for such a constructor so that the implementation class can bootstrap the interface.

5.1.1. getParticipantRepository

public ParticipantRepository getParticipantRepository()

Returns a repository that maintains Participants.

Returns:

the ParticipantRepository of the VTS, or null if no ParticipantRepository is available.

5.1.2. getVoucherComponentRepository

public VoucherComponentRepository getVoucherComponentRepository()

Returns a repository that maintains VoucherComponents.

Returns:

the VoucherComponentRepository of the VTS, or null if no VoucherComponentRepository is available.

5.2. ParticipantRepository

public interface ParticipantRepository

Provides the access points of Participants. A ParticipantRepository maintains Participants and acts as an "address book" of trading partners.

The object implementing this interface maintains Participants (or holds a reference to an object maintaining Participants), which are to be trading partners.

The implementation of a ParticipantRepository may be either (an adaptor to) "yellow pages", which is a network-wide directory service like LDAP, or "pocket address book", which maintains only personal acquaintances.

5.2.1. lookup

public Participant lookup(String id)

Retrieves the participant that has the specified id.

Returns:

the participant associated with the specified id, or null if the id is null or the corresponding participant cannot be found.

5.3. Participant

public interface Participant

Represents the participants (such as issuers, holders, and collectors).

This interface is used as a representation of the trade partners and issuers of vouchers. Anyone can retrieve objects that implement Participants from the participant repository.

5.3.1. getIdentifier

public String getIdentifier()

Returns the identifier of the participant. Each participant must have a unique identifier.

The identifier can be used for looking up and retrieving the participant via the ParticipantRepository.

The format of the identifier is implementation-specific.

Returns:

the identifier string of the participant.

5.3.2. getVTSAgent

VTSAgent getVTSAgent()

Returns a VTSAgent, whose identifier is the same as the identifier of the participant.

Returns:

an object that implements the VTSAgent.

5.4. VTSAgent

public interface VTSAgent extends Participant

Represents contact points to access vouchers in a Valid Voucher Set (VVS) that is managed by the VTS.

Each VTSAgent is associated with a holder and provides a means for managing vouchers owned by the holder. The holder must be authenticated using the login() method before being called by any other method, otherwise, a VTSSecurityException will be issued.

Before any trading method is called, e.g., issue(), transfer(), consume(), and present(), the application must establish a session by the prepare() method.

Due to network failure, sessions may often be suspended when the voucher is sent via a network. The suspended sessions can be restarted by the resume() method. Details on the state management of a session are described in Section 5.5.

Some VTSAgents may not have all of the trading methods; a voucher collecting system doesn't require its VTSAgent to provide a method for issuing or creating vouchers. A VTSAgent returns a FeatureNotAvailableException when an unsupported method is invoked.

5.4.1. login

```
public void login(String passphrase)
       throws VTSException
```

Authenticates the VTSAgent. The passphrase is specified if the VTS requires it for authentication, otherwise it must be null. Nothing is performed if the VTSAgent has already been logged-in. The authentication scheme is implementation-specific. Examples of the implementation are as follows:

1) Vouchers are managed on a remote centralized server (centralized VTS), which requires a password to login. In this case, the application may prompt the user to input the password and the password can be given to the VTSAgent through this method. For further information, see the Implementation Notes below.

2) Vouchers are managed on a remote centralized server (centralized VTS), which requires challenge-and-response authentication using smartcards held by users. In this case, the passphrase may be null because access to the smartcard can be done without contacting the application or user (i.e., the VTSAgent receives the challenge from the server, sends the challenge to the smartcard (within the VTS), and returns the response from the smartcard to the server). Note that a PIN to unlock the smartcard may be given through this method, depending on the implementation.

3) Each user holds their own smartcard in which their own vouchers are stored (distributed VTS). In this case, the passphrase may be null because no authentication is required. Note that a PIN to unlock the smartcard may be given, though this depends on the implementation.

Implementation Notes:

A VTS is responsible for providing secure ways for users to login(). It is strongly recommended that secure communication channels such as [TLS] be used if secret or private information is sent via networks. Fake server attacks, including the so-called MITM (man-in-the-middle), must be considered as well.

Throws:

VTSSecurityException - if authentication fails.

5.4.2. logout

```
public void logout()
       throws VTSException
```

Voids the authentication performed by the login() method.

After this method is called, calling any other method (except login()) will cause a VTSSecurityException.

The VTSAgent can login again by the login() method.

Throws:

VTSSecurityException - if the VTSAgent is not authenticated correctly.

5.4.3. prepare

```
public Session prepare(Participant receiver)
       throws VTSException
```

Establishes a session that is required for trading vouchers. The trading partner who receives the vouchers is specified as the receiver. The vouchers to be traded will be specified later (when a trading method is called).

The establishment of a session is implementation-specific. A centralized VTS implementation may start a transaction, while a distributed VTS implementation may get the challenge needed to create an authentic response from the receiver in the following trading method.

If the VTSAgent does not have the ability to establish a session with the specified receiver (permanent error), the VTSAgent throws an InvalidParticipantExeption. If the VTSAgent cannot establish a session due to network failure (transient error), the VTSAgent throws a CannotProceedException.

Parameters:

receiver - the trading partner who receives vouchers.

Returns:

an established session whose state is "prepared" (see Section 5.5).

Throws:

CannotProceedException - if the preparation of the session is aborted (e.g., network failures).

FeatureNotAvailableException - if the VTSAgent does not provide any trading methods.

InvalidParticipantException - if the specified participant is invalid.

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.4. issue

```
public void issue(Session session,
                  VoucherComponent promise,
                  java.lang.Number num)
        throws VTSException
```

Issues vouchers. This method creates the specified number of vouchers <this, promise, receiver> and adds them to the VVS. If the VTS is distributed, this method would create a "response" that corresponds to the challenge received in the prepare() method and send it to the receiver. Note that the receiver is specified when prepare() is called. Nothing is performed if the specified number is 0.

The session MUST be "prepared" when calling this method. The state of the session will be "activated" when the vouchers are created, and it will be "completed" when the transaction is successfully completed or "suspended" if the transaction is interrupted abnormally (e.g., network failures).

Parameters:

session - the session used by the issue transaction.

promise - the promise part of the voucher.

num - the number of vouchers to be issued.

Throws:

CannotProceedException - if the transaction cannot be successfully completed.

FeatureNotAvailableException - if the VTSAgent does not provide a means of issuing vouchers.

InvalidStateException - if the session is not "prepared".

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.5. transfer

```
public void transfer(Session session,
                     Participant issuer,
                     VoucherComponent promise,
                     java.lang.Number num)
    throws VTSException
```

Transfers vouchers. This method rewrites the specified number of vouchers <issuer, promise, this> to <issuer, promise, receiver> in the VVS; i.e., deletes the vouchers from the sender and stores them for the receiver. Similar to issue(), this method would create and send the response to the receiver if the VTS is distributed. The VTSAgent must have sufficient vouchers in the VVS. Nothing is performed if the specified number is 0.

The session MUST be "prepared" when calling this method. The state of the session will be "activated" when the voucher are retrieved from the sender, and it will be "completed" when the transaction is successfully completed or "suspended" if the transaction is interrupted abnormally (e.g., network failures).

If null is specified for the issuer parameter, it indicates "any issuer". This method selects vouchers to be transferred from the set of vouchers returned by the getContents(null, promise).

Parameters:

session - the session used by the transfer transaction.

issuer - the issuer part of the voucher, or null.

promise - the promise part of the voucher.

num - the number of vouchers to be transferred.

Throws:

CannotProceedException - if the transaction cannot be successfully completed.

FeatureNotAvailableException - if the VTSAgent does not provide a means of transferring vouchers.

InsufficientVoucherException - if the VTSAgent does not have a sufficient number of vouchers to transfer.

InvalidStateException - if the session is not "prepared".

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.6. consume

```
public void consume(Session session,
                    Participant issuer,
                    VoucherComponent promise,
                    java.lang.Number num)
        throws VTSException
```

Consumes vouchers. This method deletes the specified number of vouchers <issuer, promise, this> from the VVS and notifies the receiver of the deletion. Similar to issue() and transfer(), the response would be created and sent to the receiver if the VTS is distributed so that the receiver can obtain proof of the deletion. The VTSAgent must have a sufficient number of vouchers in the VVS. Nothing is performed if the specified number is 0.

The session MUST be "prepared" when this method is called. The state of the session will be "activated" when the vouchers are deleted, and it will be "completed" when the transaction is successfully completed or "suspended" if the transaction is interrupted abnormally (e.g., network failures).

If null is specified for the issuer parameter, it indicates "any issuer". This method selects vouchers to be consumed from the set of vouchers returned by the getContents(null, promise).

Parameters:

session - the session used by the consume transaction.

issuer - the issuer part of the voucher, or null.

promise - the promise part of the voucher.

num - the number of vouchers to be consumed.

Throws:

CannotProceedException - if the transaction cannot be successfully completed.

FeatureNotAvailableException - if the VTSAgent does not provide a means of consuming vouchers.

InsufficientVoucherException - if the VTSAgent does not have a sufficient number of vouchers to consume.

InvalidStateException - if the session is not "prepared".

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.7. present

```
public void present(Session session,
                    Participant issuer,
                    VoucherComponent promise,
                    java.lang.Number num)
        throws VTSException
```

Presents vouchers. This method shows that the sender has the specified number of vouchers <issuer, promise, this> in the VVS to the receiver of the session; no modification is performed to the VVS. However, the response would be sent to the receiver as well as consume() in order to prove that the VTS has been distributed. The VTSAgent must have a sufficient number of vouchers in the VVS. Nothing is performed if the specified number is 0.

The session MUST be "prepared" when this method is called. The state of the session will be "activated" when the vouchers are

retrieved, and it will be "completed" when the transaction is successfully completed or "suspended" if the transaction is interrupted abnormally (e.g., by network failures).

If null is specified for the issuer parameter, it indicates "any issuer". This method selects vouchers to be presented from the set of vouchers returned by the getContents(null, promise).

Parameters:

session - the session used by the present transaction.

issuer - the issuer part of the voucher, or null.

promise - the promise part of the voucher.

num - the number of the voucher to be presented.

Throws:

CannotProceedException - if the transaction cannot be successfully completed.

InsufficientVoucherException - if the VTSAgent does not have a sufficient number of vouchers to present.

InvalidStateException - if the session is not "prepared".

FeatureNotAvailableException - if the VTSAgent does not provide a means of presenting vouchers.

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.8. cancel

```
public void cancel(Session session)
       throws VTSException
```

Releases the session. "Prepared" sessions MUST be canceled. An implementation MAY be permitted to cancel "activated" or "suspended" sessions.

Throws:

InvalidStateException - if the state of the session cannot be canceled.

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.9. resume

```
public void resume(Session session)
       throws VTSException
```

Restarts the session. Only "suspended" sessions can be resumed. The state of the session will be re-"activated" immediately, and it will be "completed" when the transaction is successfully completed or "suspended" again if the transaction is interrupted abnormally (e.g., network failures).

Throws:

CannotProceedException - if the transaction cannot be successfully completed.

InvalidStateException - if the session is not "suspended".

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.10. create

```
public void create(VoucherComponent promise, java.lang.Number num)
       throws VTSException
```

Creates vouchers where the issuer is the VTSAgent itself. This method creates the specified number of vouchers <this, promise, this> and adds them to the VVS. Nothing is performed if the specified number is 0.

Throws:

FeatureNotAvailableException - if the VTSAgent does not provide a means of creating vouchers.

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.11. delete

```
public void delete(Participant issuer, VoucherComponent promise,
                   java.lang.Number num)
       throws VTSException
```

Deletes vouchers. This method deletes the specified number of vouchers <issuer, promise, this> from the VVS. The VTSAgent must have sufficient vouchers in the VVS. Nothing is performed if the specified number is 0.

Throws:

InsufficientVoucherException - if the VTSAgent does not have a sufficient number of vouchers to delete.

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.12. getContents

```
public java.util.Set getContents(Participant issuer,
                                 VoucherComponent promise)
       throws VTSException
```

Returns the set of vouchers whose issuer and promise both match the issuer and promise specified in the parameters.

If null is specified for the issuer or promise parameter, it indicates "any issuer" or "any promise", respectively. If null is specified for both parameters, this method selects all vouchers owned by the holder from the VVS.

Returns:

the set of vouchers held by the holder of the VTSAgent.

Throws:

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.13. getSessions

```
public java.util.Set getSessions()
       throws VTSException
```

Returns a set of incomplete sessions prepared by the VTSAgent.

Returns:

the set of sessions prepared by the VTSAgent that are not yet completed.

Throws:

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.14. getLog

```
public java.util.Set getLog()
       throws VTSException
```

Returns a set of completed sessions prepared or received by the VTSAgent. This set represents the trading log of the VTSAgent. A VTS may delete an old log eventually, so that the entire log may not be returned; the amount of the log kept by the VTSAgent is implementation-specific.

Returns:

the set of completed sessions prepared or received by the VTSAgent.

Throws:

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.15. addReceptionListener

```
public void addReceptionListener(ReceptionListener l)
       throws VTSException
```

Adds a ReceptionListener to the listener list.

After a ReceptionListener l is registered by this method, l.arrive() will be called whenever the VTSAgent receives a voucher.

Nothing is performed if the specified listener is null.

Throws:

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.4.16. removeReceptionListener

```
public void removeReceptionListener(ReceptionListener l)
       throws VTSException
```

Removes a ReceptionListener from the listener list.

Nothing is performed when the specified listener is null or not registered.

Throws:

VTSSecurityException - if the VTSAgent cannot be authenticated correctly.

5.5. Session

```
public interface Session
```

Represents the logical connection established by the trade. Sessions are established by VTSAgent#prepare().

A session has four states: prepared, activated, suspended, and completed. The initial state of a session is "prepared", and the session will be "activated" immediately when any of the trading methods of VTSAgent is called. The "activated" session will be "completed" after the trading method is successfully completed. If the trading method fails transiently (e.g., network failure), the session will be "suspended". Suspended sessions can be re-"activated" and restarted by calling VTSAgent#resume().

A completed session may disappear from the VTSAgent; the session will be collected by the GC unless other objects keep its reference.

5.5.1. getIdentifier

```
public String getIdentifier()
```

Returns the identifier of the session. The generation scheme of the identifier is implementation-specific. An implementation may use a transaction ID as the identifier of the session.

Returns:

the string of the identifier of the session.

5.5.2. getVoucher

```
public Voucher getVoucher()
```

Returns the voucher to be traded using the session, or returns null if the session has not been activated.

Returns:

the voucher to be traded, or null if the state of the session is "prepared".

5.5.3. getSender

```
public Participant getSender()
```

Returns the sender of the session (i.e., the creator who prepared the session).

Returns:

the sender of the session.

5.5.4. getReceiver

```
public Participant getReceiver()
```

Returns the receiver of the session (i.e., the participant specified when preparing the session (by the VTSAgent#prepare() method)).

Returns:

the receiver of the session.

5.5.5. isPrepared

```
public boolean isPrepared()
```

Verifies if the session is "prepared".

Returns:

true if the session is in the "prepared" state, otherwise, false.

5.5.6. isActivated

```
public boolean isActivated()
```

Verifies if the session is "activated".

Returns:

true if the session is in the "activated" state, otherwise, false.

5.5.7. isSuspended

```
public boolean isSuspended()
```

Verifies if the session is "suspended".

Returns:

true if the session is in the "suspended" state, otherwise, false.

5.5.8. isCompleted

```
public boolean isCompleted()
```

Verifies if the session is "completed".

Returns:

true if the session is in the "completed" state, otherwise, false.

5.6. Voucher

```
public interface Voucher
```

Represents voucher(s) described in [VTS]. An object implementing this interface can represent more than one voucher if all of the issuer part and the promise part of the vouchers are the same.

5.6.1. getIssuer

```
public Participant getIssuer()
```

Returns the issuer part of the voucher(s).

Returns:

the participant who issued the voucher(s).

5.6.2. getPromise

public VoucherComponent getPromise()

Returns the promise part of the voucher(s).

Returns:

the voucher component that defines the promise of the voucher.

5.6.3. getCount

public java.lang.Number getCount()

Returns the number of the voucher(s).

Returns:

the positive (>0) number of the voucher(s).

5.7. VoucherComponentRepository

public interface VoucherComponentRepository

Maintains VoucherComponents.

An object implementing VoucherComponentRepository provides a means of retrieving the voucher components that are the promises of vouchers in the VVS.

Before issuing a voucher, the promise of the voucher must be registered with this repository. The repository can be implemented as either a network-wide directory service or personal storage like the ParticipantRepository.

5.7.1. register

public VoucherComponent register(org.w3c.dom.Document document)

Creates a voucher component associated with the specified DOM object and registers the voucher component with the repository.

A voucher component of the voucher to be issued must be registered using this method.

Nothing is performed (and the method returns null) if the specified document is null or the syntax of the document does not conform to the VTS.

The method returns the registered voucher component if the specified DOM object has been already registered (no new voucher component is created in this case).

Returns:

a registered voucher component associated with the specified document, or null if the document is null or has wrong syntax.

5.8. VoucherComponent

public interface VoucherComponent

Represents the voucher component that defines the promise of the voucher.

Each VoucherComponent object has its own unique identifier and is associated with an XML document that describes the promise made by the issuer of the voucher (e.g., goods or services can be claimed in exchange for redeeming the voucher).

This interface can be implemented as sort of a "smart pointer" to the XML document. An implementation may have a reference to a voucher component repository instead of the voucher component, and it may retrieve the document dynamically from the repository when the getDocument() method is called.

5.8.1. getIdentifier

public String getIdentifier()

Returns the identifier of the voucher component. Each voucher component must have a unique identifier. The identifier may be used to check for equivalence of voucher components.

The format of the identifier is implementation-specific, however, it is RECOMMENDED that the hash value of the voucher component in the identifier be included to assure uniqueness. For generating the hash value, it is desirable to use a secure hash function (e.g., [SHA-1]) and to apply a canonicalization function (e.g., [EXC-C14N]) before applying the hash function to minimize the impact of insignificant format changes to the voucher component, (e.g., line breaks or character encoding).

Returns:

the identifier string of the voucher component.

5.8.2. getDocument

public org.w3c.dom.Document getDocument()

Returns a Document Object Model [DOM] representation of the document associated with the voucher component by the VoucherComponentRepository#register() method.

The DOM object to be returned may be retrieved from a VoucherComponentRepository on demand, instead of the VoucherComponent always keeping a reference to the DOM object.

The VTS must guarantee that the getDocument method will eventually return the DOM object, provided that the voucher associated with the corresponding voucher component exists in the VVS.

Returns:

a DOM representation of the document associated with the voucher component.

Throws:

DocumentNotFoundException - if the associated DOM object cannot be retrieved.

5.9. ReceptionListener

public interface ReceptionListener extends java.util.EventListener

Provides a listener interface with a notification that a VTSAgent has received a voucher.

When a voucher arrives at the VTSAgent, the VTSAgent invokes the arrive() method of each registered ReceptionListener. ReceptionListeners can obtain a Session object, which contains information about the received voucher and the sender of the voucher.

This interface is intended to provide a means of notifying a wallet that "You have new vouchers", so that this interface may be implemented by wallets or other applications that use VTS.

5.9.1. arrive

public void arrive(Session session)

Provides notification of the arrival of a voucher.

After the listener is registered to a VTSAgent (by the VTSAgent#addReceptionListener() method), the VTSAgent invokes this method whenever it receives a voucher.

The specified session is equivalent to the session used by the sender to trade the voucher. The state of the session is "completed" when this method is called.

5.10. Exceptions

```
java.lang.Exception
  +-- VTSException
      +-- CannotProceedException
      +-- DocumentNotFoundException
      +-- FeatureNotAvailableException
      +-- InsufficientVoucherException
      +-- InvalidParticipantException
      +-- InvalidStateException
      +-- VTSSecurityException
```

VTSException
This is the superclass of all exceptions thrown by the methods in the interfaces that construct the VTS-API.

CannotProceedException
This exception is thrown when a trading is interrupted by network failures or other errors.

DocumentNotFoundException
This exception is thrown when the document associated with a voucher component cannot be found.

FeatureNotAvailableException
This exception is thrown when the invoked method is not supported.

InsufficientVoucherException
This exception is thrown when the number of the voucher is less than the number specified for trading.

InvalidParticipantException
This exception is thrown when the specified participant cannot be located.

InvalidStateException
This exception is thrown when the state of the session is invalid and the operation cannot proceed.

VTSSecurityException
This exception is thrown when authentication fails, or when a method that requires authentication in advance is called without authentication.

6. Example Code

```
// Issue a voucher

VTSManager vts = new FooVTSManager();
ParticipantRepository addrBook = vts.getParticipantRepository();
VoucherComponentRepository vcr = vts.getVoucherComponentRepository();

Participant you = addrBook.lookup("http://example.org/foo");
  // looks up a trading partner identified as
  // "http://example.org/foo".
VTSAgent me = addrBook.lookup("myName").getVTSAgent();
  // a short-cut name may be used if VTS implementation allows.

VoucherComponent promise = vcr.register(anXMLVoucherDocument);
  // registers a voucher component that corresponds to the voucher
  // to be issued.

try {
  me.login();
    // sets up the issuer's smartcard (assuming distributed VTS).
  s = me.prepare(you);
    // receives a challenge from the partner.
  me.issue(s, promise, 1);
    // sends a voucher using the received challenge.
  me.logout();
} catch (VTSException e) {
    // if an error (e.g., a network trouble) occurs...
  System.err.println("Sorry.");
  e.printStackTrace();
    // this example simply prints a stack trace, but a real wallet
    // may prompt the user to retry (or cancel).
}

// Transfer all my vouchers

VTSManager vts = new FooVTSManager();
ParticipantRepository addrBook = vts.getParticipantRepository();

Participant you = addrBook.lookup("8f42 5aab ffff cafe babe...");
  // some VTS implementations would use a hash value of a public key
  // (aka fingerprint) as an identifier of a participant.
VTSAgent me = addrBook.lookup("myName").getVTSAgent();
```

```
   try {
     me.login();
     Iterator i = me.getContents(null, null).iterator();

     while (i.hasNext()) {
       Voucher v = (Voucher) i.next();
       s = me.prepare(you);
       me.transfer(s, v.getIssuer(), v.getPromise(), v.getCount());
     }

     me.logout();
   } catch (VTSException e) {
     System.err.println("Sorry.");
     e.printStackTrace();
   }

   // Register an incoming voucher notifier (biff)

   VTSManager vts = new FooVTSManager();

   ParticipantRepository addrBook = vts.getParticipantRepository();
   VTSAgent me = addrBook.lookup("myName").getVTSAgent();

   ReceptionListener listener = new ReceptionListener() {
     public void arrive(Session s) {
       System.out.println("You got a new voucher.");
     }
   };

   try {
     me.login();
     me.addReceptionListener(listener);
     me.logout();
   } catch (VTSException e) {
     System.err.println("Sorry.");
     e.printStackTrace();
   }
```

7. Security Considerations

Security is very important for trading vouchers. VTS implementations are responsible for preventing illegal acts upon vouchers (as described in [VTS]), as well as preventing malicious access from invalid users and fake server attacks, including man-in-the-middle attacks.

The means to achieve the above requirements are not specified in this document because they depend on VTS implementation. However,

securing communication channels (e.g., using TLS) between client VTS plug-ins and the central server in a centralized VTS (as described in 5.4.1 login()), and applying cryptographic challenge-and-response techniques in a distributed VTS are likely to be helpful and are strongly recommended to implement a secure VTS.

This document assumes that the VTS plug-in is trusted by its user. The caller application of a VTS should authenticate the VTS plug-in and bind it securely using the VTS Provider information specified in the Voucher Component. This document, however, does not specify any application authentication scheme and it is assumed to be specified by other related standards. Until various VTS systems are deployed, it is enough to manually check and install VTS plug-ins like other download applications.

8. Acknowledgements

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Donald Eastlake 3rd
Iguchi Makoto
Yoshitaka Nakamura
Ryuji Shoda

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